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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant(s):	Vasel et al.
Serial No.:	09/289,258
Filed:	4/9/99
For:	NON-LETHAL PROJECTILE FOR DELIVERING AN INHIBITING SUBSTANCE TO A LIVING TARGET
Group Art Unit:	3641
Examiner:	Tudor, H.

DECLARATION PURSUANT TO 37 C.F.R. § 1.132

Hon. Commissioner for Patents
Washington, D.C. 20231

Sir:

I, Edward J. Vasel, declare as follows:

1. I am currently the Vice President of Engineering and New Product Development of Jaycor Tactical Systems, Inc. (hereafter referred to as "JTS"). I have been in this position for about 1½ years. Prior to my current position, I was the Director of Engineering with JTS. Prior to my position with JTS, I was a Senior Scientist at Jaycor for about 20 years.

2. I have a B.S. in Aerospace Engineering from Kent State University (1972) and have experience with non-lethal technologies, space optics, nuclear underground testing, fluid dynamics, aerodynamics and

bio-mechanics. I was awarded a Kent State University Distinguished Alumni Award for my work with non-lethal technology research. Attached as Exhibit A is a copy of my Curriculum Vitae.

3. I am a joint inventor of the invention as variously described in U.S. Patent Application No. 09/289,258.

4. One of the key features to some of the variations of the inventions is that a launchable projectile delivers a powdered irritant to a living person. The projectile is impacted on the living person or on a surface near the living person. Upon impact, the projectile fractures and the powdered irritant radially disperses into a cloud that the person inhales. It is important that the powder radially disperse into as a cloud having a large volume to ensure that the person will inhale the powdered irritant. By creating the powder cloud, the projectiles may safely impact the living person at areas of the body other than the facial region. Additionally, surfaces next to the living person may be impacted, which stills creates a powdered cloud that the person inhales. Once inhaled, the person begins coughing and has difficulty breathing, making it easy for law enforcement to effect an arrest.

5. A powdered irritant, rather than a liquid irritant, was specifically chosen for many of the projectiles described in the patent application since a liquid irritant will not create a cloud that radially

disperse upon impact. The powder irritant also offers many advantages over the liquid irritant.

6. Tests were performed to determine the effect of the radial dispersion of both liquid and powder chemical agents while varying the amount of volume within the projectile "filled" with the chemical agent.

7. The tests involved the use of a hollow, frangible projectile used in our Pepperball product, which is describes in the above mentioned patent application and which contains the chemical agent. The projectile resembles a common paintball. The volume within the projectiles was filled with varying amounts of liquid and powder chemical agents and impacted against a mannequin to quantify and compare the resulting dispersion. A bench-mounted compressed gas launcher (JTS Model No. SA 200) was used to deliver the frangible projectiles to the target. The compressed gas launcher was configured to impact the target at a force of about 10 ft-lbs. A clean T-shirt was placed over the target, a mannequin, for each impact. The impact for each projectile was videotaped and freeze frame data points were taken.

8. Liquid Fill Tests. Projectiles were filled with a water soluble dye at fills of 10%, 25%, 50%, 75% and 99% of the available volume within the hollow projectile. Freeze frame data points for the dispersion of the liquid dyes are shown in FIG. 1, which is attached hereto.

9. As can be seen, at 10% liquid fill, the size of the liquid dispersion on the T-shirt (i.e., the area of the liquid on the shirt) appears to be slightly smaller than the resulting dispersion at 25%, 50%, 75% and 99%. As the liquid fill was increased, it was generally observed that a few small droplets of the liquid would splatter outside of the dye spot formed in the shirt of the mannequin. For example, at 75% and 99% fills, there was a drop or two that landed on the neck or chin of the mannequin. No liquid was observed contacting the mouth, nose or eyes of the mannequin.

10. It was also found that the size of the dispersion (in other words, the area of the spot on the T-shirt) did not increase significantly as the liquid fill increased. From FIG. 1, the size of the dispersion was approximately the same at liquid fills of 50%, 75% and 99%. It was noted that at increasing fills, more liquid dye saturated approximately the same area or localized spot.

11. Powder Fill Tests. In these tests, projectiles were filled with an inert training powder at fills of 10%, 25%, 40%, 50%, 75% and 99% of the available volume within the hollow projectile. The impact was backlit to highlight the powder dispersion and videotaped. Freeze frame data points for the powder dispersion are shown in FIG. 2, which is attached hereto.

12. In contrast to the Liquid Tests, as the powder fill increased, the overall radial dispersion (the volume of the powder cloud) increased. At 10%, 25% and

40% fills, a minimum powder dispersion is seen. At 50% fill, the powder cloud expands to the point where it could be inhaled by a person. And at powder fills greater than 50%, e.g., 75% and 99%, the powder cloud was observed to be about 2-3 feet in diameter swirling around the head and face regions of the target. Thus, as the powder fill is increased, the volume of the powder dispersion increases.

13. It is also observed that only the thickest portions of the powder cloud appear in FIG. 2, due to the presence of very fine powdered particles in the air which do not easily photograph. Thus, the powder clouds released are actually slightly larger than indicated in FIG. 2.

14. Also attached is FIG. 3, which illustrates a field test on a person holding a knife using projectiles having a 99% powder fill. In the first photograph, the person is struck in the upper chest with a first projectile. The radial powder dispersion can be seen in the second photograph as completely enveloping the person's head. In the third photograph, a second projectile is impacted, while the powder cloud from the first projectile further expands. In this test, the person impacted was forced to drop the knife and comply, shown in the fourth photo. As can clearly be seen, the powder cloud expands to a volume about 2-3 feet or more in diameter, which is sufficient to expand into the facial region of the target to be inhaled.

15. From these tests, I conclude that as the liquid fill of a projectile increases, the resulting size of the liquid dispersion does not generally increase. In other words, the size of the liquid dispersion remains about the same, but is more concentrated.

16. I also conclude that, in contrast to the liquid fills, as the powder fill of a projectile increases, the resulting volume of the powder dispersion increases. In other words, the resulting powder cloud is larger.

17. Additionally, above about 50% powder fill, the released powder cloud is sufficient to expand toward the facial region of the person, ensuring that the person will inhale the powder. In contrast, above about 50% liquid fill, the size of the liquid dispersion remains about the same.

18. These results are surprising. It might seem intuitive that more powder fill would yield a *denser* powder cloud, but it is not intuitive that more powder fill should yield a *larger* cloud. This is surprising because each of the projectiles were impacted at the same kinetic impact. It would seem that upon impact, the powder scatters with angular velocities correlating to the impact momentum of the projectile, which would be about the same for the various fills. It may also be intuitive that as the powder fill increased, that the powder might clump together and not disperse as well as a lesser fill; however, the tests clearly show this not to be the case. One explanation may be that as the fill

becomes greater, more air particles are trapped in between the powder particles such that upon impact, the powder particles compress against the air within, which generates additional angular accelerations in the powder particles; thus, creating a larger cloud.

19. Whatever the explanation, as a result, certain minimum powder fills are needed in order to provide a powder dispersion sufficient to reach the facial region of a living person. In this example, it is desirable to use a powder fill of greater than 50%.

20. As I am advised I must, I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application, any patents issuing thereon, or any patent to which this Declaration is directed.

Edward J. Vasel

Edward J. Vasel

Dated: 7/17, 2001

Attachments: Exhibit A
FIGS. 1-3

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